The sensitivity of the Healthy Life Years indicator: Life table techniques and questions about dealing with age-specific prevalence data

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Abstract

The Healthy Life Years indicator (HLY) has been developed for monitoring population health in Europe over time and across countries. In technical terms, HLY combines the period life table provided by Eurostat with the disability prevalence data obtained from the European Union Statistics on Income and Living Conditions (EU-SILC). The combination of health and mortality data requires several assumptions both on the mortality and health part, but is especially important with regards to the prevalence of disability by age and its distribution. For instance, EU-SILC includes only people between age 16 and 84 (85+ is the last open age interval); therefore, additional assumptions for very young and old persons are required. The conventional approach assumes that the prevalence of being unhealthy for individuals younger than age 16 is half of the prevalence for 16 to 20 years-old. Further, the current procedure relies on prevalence data aggregated in 5-years age intervals, assuming a constant proportion of unhealthy individuals in each 5-years age interval. The aim of this paper is to assess whether changing these assumptions and adopting different prevalence distributions by age can lead to different HLY results. For this purpose, we test how several strategies to yield prevalence distributions are affected by different age intervals, smoothing methods and graduating mortality before computing the life table. By addressing how sensitive the HLY indicator is to different estimation approaches, we aim to evaluate whether there are any implications regarding monitoring population health on the basis of HLY in

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Europe.

1. Introduction

Healthy Life Years (HLY) has been widely acknowledged as the most important indicator for population health. It does not only enable researchers to investigate the proportion of life years spent in good or poor health, its trend over time (the "compression-expansion-debate"), and differences between women and men, but it has also been established as the official European Union indicator for monitoring health (

Jagger **andothers** 2013;

Van Oyen **andothers** 2013;

Nusselder **andothers** 2019;

Colin D Mathers 2002). Its construction combines mortality and morbidity in a single indicator, incorporating the health dimension into the life table (

Saito, J. M. Robine **and** Crimmins 2014). Even though several methods have been proposed for this purpose, the approach developed by Sullivan (

Sullivan 1971) is the most widely employed up to now (

Yokota **andothers** 2019;

J.-M. Robine **and** C. D Mathers 1993). It relies on readily available age-specific prevalence (proportions) of the population in different health states, usually obtained from cross-sectional survey data, to apportion the life table person-years lived between the states of good and poor health.

However, because information on disability is usually derived from population surveys that are limited to specific age ranges, these indicators can be also highly sensitive to particular technical features. These include the age range and its partitioning selected for analysis and the technique chosen to add the health dimension to the life table. Among these issues, the latter has been addressed and discussed in detail (e.g. Crimmins et al. 1993; Mathers 2002; Robine et al. 2001). Much effort has been directed to evaluate the role of the GALI instrument, harmonization issues and comparability (

Berger **andothers** 2015). Nonetheless, the choice of method and the sensitivity of this indicator is rarely taken into account when empirically analysing levels and trends of health expectancy and their role when interpreting the results.

In this paper, we assess whether changing the most commonly used assumptions to estimate HLY and adopting different prevalence distributions by age can lead to different results. On a first step, we test whether smoothing the prevalence distribution by age according to different approaches has any implication on the posterior HLY estimates. We also test whether changing assumptions of the prevalence rates before the age of 16 affect the distributions, as well as by single-, 5-year and 10-year age intervals. On a second step, we graduate mortality rates from the Human Mortality Database (

HMD 2018) to evaluate if smoothing mortality patterns may affect HLY estimates. Lastly, we compute HLY for each one of those cases and check whether country rankings in Europe vary by type of smoothing technique, age partitioning, and mortality graduation.

2. Data and Methods

The observed prevalence of any long-lasting daily living activity limitations is obtained from the European Union Statistics on Income and Living Conditions (EU-SILC). The exact wording of the so-called "Global Activity Limitation Indicator" (GALI) is: "For at least the past 6 months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been (1) severely limited, (2) limited but not severely, or (3) not limited at all?". This is the official Eurostat HLE indicator used to monitor health status, where individuals are defined as healthy if they report no limitations at all. The advantage of using the GALI instrument in order to estimate HLE is that it has been more systematically assessed in order to ensure the highest level possible of harmonization and comparability of health dimensions, age and time across European countries (Berger, Robine, Ojima, Madans, Van Oyen, 2016; Jagger et al., 2010; Van Oyen, Heyden, Perenboom, Jagger, 2006). We use the most commonly used approach for extending LE to HLE, which is the Sullivan method (Sullivan 1971). It is based on the idea of applying the age-specific prevalence (proportions) of a population in an (un)healthy state to the age-specific person-years lived from the life table. In this way, the total life years in each age interval can be divided into those spent in good and those in poor health.

We use mortality data from both Eurostat and the Human Mortality Database(HMD). We smooth the prevalence by age using flexible smoothing splines and polynomial function (

P. H. C. Eilers **and** Marx 1996;

Gu **and** Kim 2002). The prevalence is also computed by single-age, 5-year and 10-year age intervals. In addition, we estimate HLY considering no disability before the age of 16 and half of the prevalence for 16 to 20 years-old, which is the conventional approach. For graduating mortality we use an approach based on the composite link model, which extends standard generalized linear models. It implements the idea that the observed counts, interpreted as realizations from Poisson distributions, are indirect observations of a finer ungrouped but latent sequence. This latent sequence represents the distribution of expected means on a fine resolution and has to be estimated from the aggregated data. Estimates are obtained by maximizing a penalized likelihood (

Rizzi, Gampe **and** P. H. Eilers 2015). This maximization is performed efficiently by version of the iteratively reweighted least-squares algorithm. Optimal values of the smoothing parameter are chosen by minimizing Bayesian or Akaike's Information Criterion. All results were computed for year 2014 since that is the year for which SILC countries have the same age range of prevalence information available.

3. Results

The first set of results refer to the prevalence rates by different smoothing methods. In Figures 1 and 2 we present the results for women, aged 0-80+, in selected European countries. The polynomial fit is the smoothing that most evens out the distribution and the single-age group the one with the most noise by age.

Figure 1: Prevalence rates for Females aged 0-80+, by different smoothing methods, year 2014, selected European countries

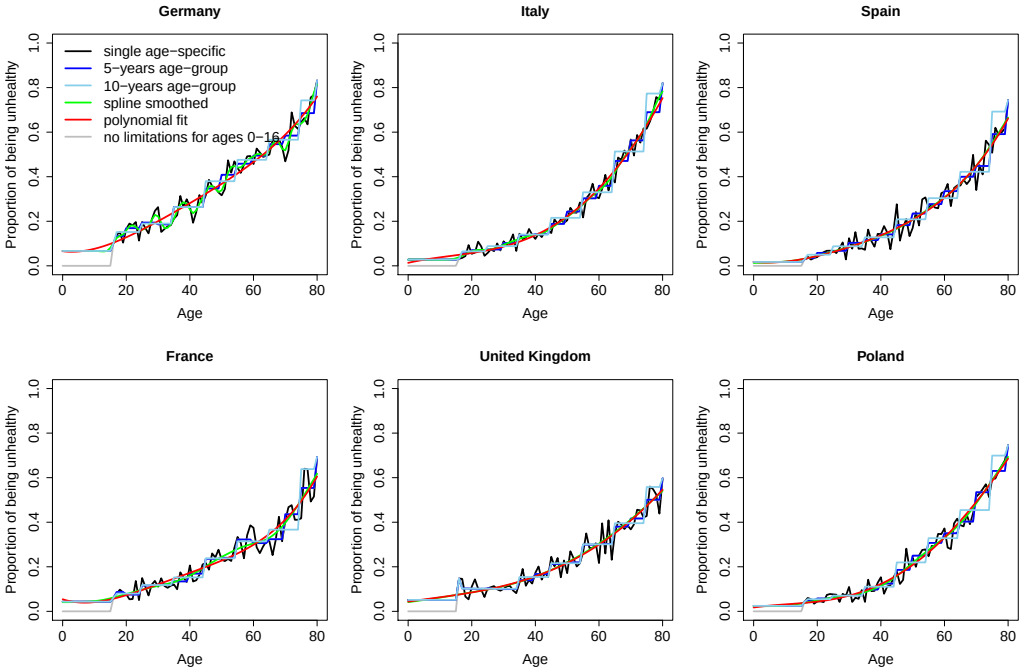
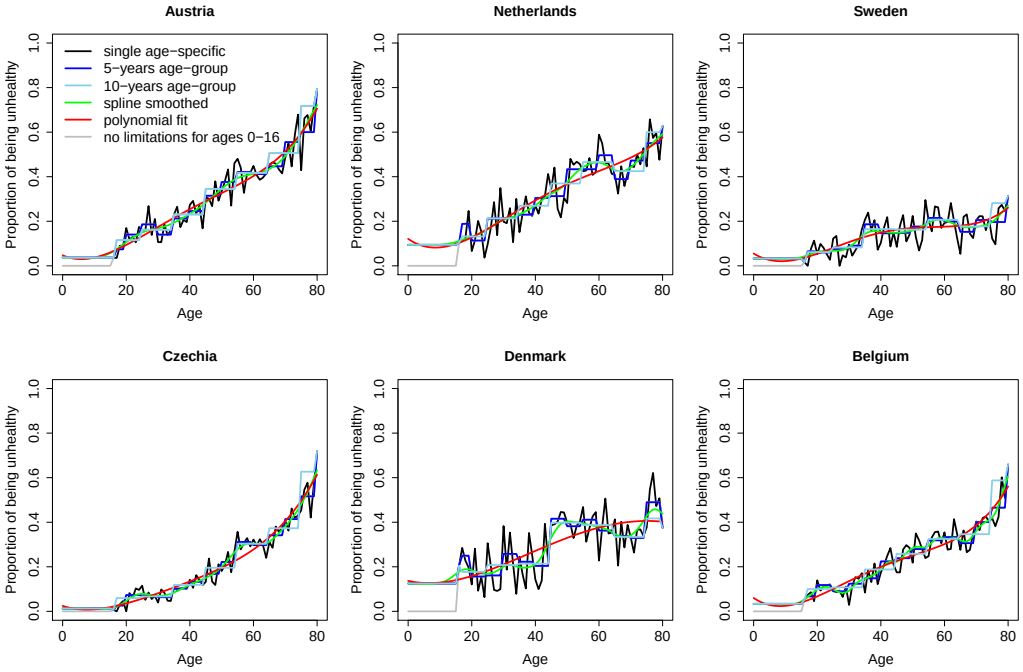


Figure 2: Prevalence rates for Females aged 0-80+, by different smoothing methods, year 2014, selected European countries



Figures 3 and 4 show the same results for men, with the polynomial fit also being the fit that most smoothes the data.

Figure 3: Prevalence rates for Males aged 0-80+, by different smoothing methods, year 2014, selected European countries

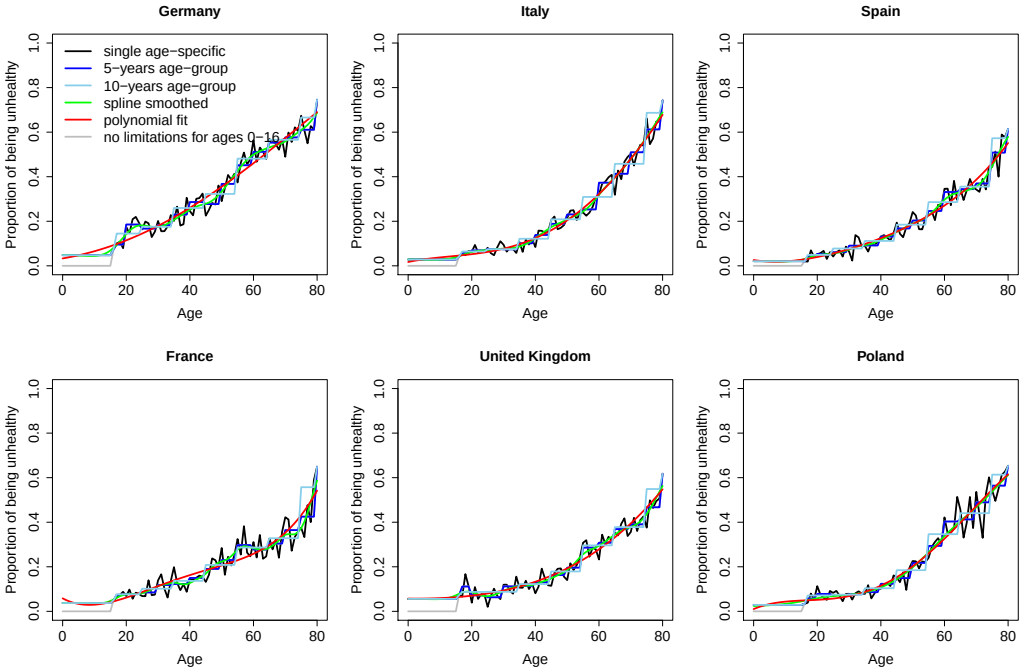
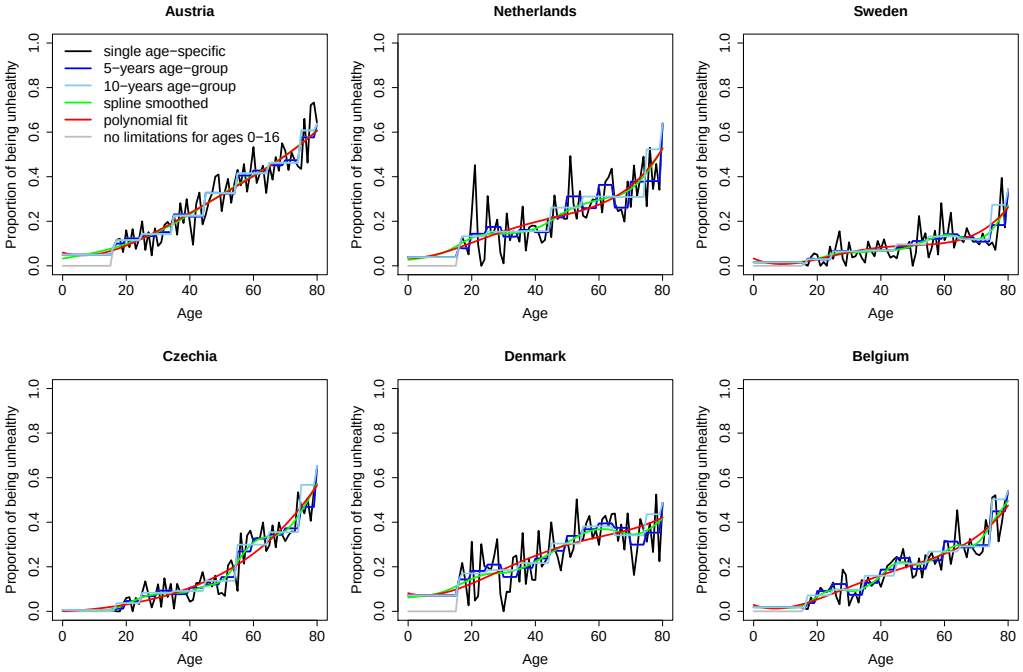


Figure 4: Prevalence rates for Males aged 0-80+, by different smoothing methods, year 2014, selected European countries



Once we estimate each one of those different curves, they were combined with the mortality data to estimate HLY by age. As seen in the upcoming Figures, the absolute differences in HLY are very small, but do matter for some country rankings. In Figure 5, Spain and Czech Republic alternate between the 10th and 11th ranking when comparing the spline and the polynomial smoothing functions for women. For men, the rankings for France and UK, as well as Denmark, Netherlands and Italy also experience some changes according to the method considered.

Figure 5: Healthy Life Years at birth, by different smoothing methods, year 2014, selected European countries, no mortality graduation

Women, at birth, Eurostat lifetable

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	55.1	1	DE	55.0	1	DE	54.8	1	DE	55.1	1	DE	54.9	1	DE	56.1	1
NL	57.8	2	NL	57.7	2	NL	57.6	2	NL	57.8	2	NL	57.8	2	NL	59.2	2
AT	58.7	3	AT	58.7	3	AT	58.1	3	AT	58.5	3	AT	58.5	3	AT	59.3	3
DK	60.4	4	DK	60.2	4	DK	60.6	4	DK	60.4	4	DK	60.3	4	DK	62.2	4
IT	62.7	5	IT	62.7	5	IT	62.4	5	IT	62.6	5	IT	62.4	5	IT	63.2	5
PL	63.2	6	PL	63.1	6	PL	63.0	6	PL	63.0	6	PL	63.0	6	PL	63.5	6
BE	64.2	7	BE	64.2	7	BE	63.8	7	BE	64.2	7	BE	64.0	7	BE	64.8	7
UK	64.5	8	UK	64.5	8	UK	64.3	8	UK	64.4	8	UK	64.4	8	UK	65.3	8
FR	64.7	9	FR	64.7	9	FR	64.4	9	FR	64.5	9	FR	64.5	9	FR	65.4	9
CZ	65.4	10	CZ	65.4	10	CZ	65.0	10	**ES**	**65.3**	**10**	**ES**	**65.2**	**10**	CZ	65.6	10
ES	65.5	11	ES	65.5	11	ES	65.1	11	**CZ**	**65.3**	**11**	**CZ**	**65.3**	**11**	ES	65.8	11
SE	72.6	12	SE	72.5	12	SE	72.2	12	SE	72.5	12	SE	72.5	12	SE	73.0	12

Men, at birth, Eurostat lifetable

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	55.2	1	DE	55.2	1	DE	55.1	1	DE	55.2	1	DE	55.2	1	DE	56.0	1
AT	58.3	2	AT	58.2	2	AT	58.2	2	AT	58.2	2	AT	58.2	2	AT	59.0	2
DK	60.0	3	DK	59.8	3	DK	59.5	3	DK	60.0	3	**DK**	**60.0**	**3**	**PL**	**60.6**	**3**
PL	60.1	4	PL	60.1	4	PL	60.0	4	PL	60.1	4	**PL**	**60.1**	**4**	**DK**	**60.9**	**4**
NL	62.7	5	NL	62.9	5	NL	62.4	5	NL	62.6	5	**NL**	**62.6**	**5**	**IT**	**63.4**	**5**
IT	62.9	6	IT	62.9	6	IT	62.7	6	IT	62.8	6	**IT**	**62.8**	**6**	**NL**	**63.5**	**6**
UK	63.6	7	UK	63.7	7	**FR**	**63.4**	**7**	UK	63.6	7	UK	63.6	7	**CZ**	64.0	7
FR	63.7	8	FR	63.8	8	**UK**	**63.4**	**8**	FR	63.7	8	FR	63.6	8	FR	64.4	8
CZ	63.9	9	CZ	63.9	9	CZ	63.6	9	CZ	63.8	9	CZ	63.8	9	**UK**	64.6	9
BE	64.7	10	BE	64.6	10	BE	64.5	10	BE	64.6	10	BE	64.6	10	BE	64.9	10
ES	65.5	11	ES	65.4	11	ES	65.2	11	ES	65.4	11	ES	65.3	11	ES	65.7	11
SE	73.1	12	SE	73.1	12	SE	72.8	12	SE	73.1	12	SE	73.1	12	SE	73.3	12

Source: SILC and Eurostat

At age 50 the absolute differences are also small, as seen on the Figure 6, but women in the Netherlands expect to rank as the third in terms of worse healthy life years when the no disability before age 16 is considered, while that ranking goes to 5, when using the polynomial smoothing. This is a difference of 2 positions in the country ranking analyzed solely based on the smoothing method.

Figure 6: Healthy Life Years at age 50, by different smoothing methods, year 2014, selected European countries, no mortality graduation

Women, age 50, Eurostat lifetable

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1
AT	16.4	2	AT	16.4	2	AT	16.0	2	AT	16.3	2	AT	16.4	2	AT	16.4	2
IT	17.5	3	**NL**	**17.5**	**3**	IT	17.4	3	IT	17.5	3	IT	17.2	3	**NL**	**17.5**	**3**
NL	17.6	4	**IT**	**17.6**	**4**	NL	17.7	4	NL	17.6	4	PL	17.6	4	**IT**	**17.6**	**4**
PL	17.7	5	PL	17.7	5	PL	17.7	5	PL	17.6	5	**NL**	**17.8**	**5**	**PL**	**17.7**	**5**
CZ	19.5	6	CZ	19.5	6	CZ	19.3	6	CZ	19.5	6	CZ	19.6	6	CZ	19.5	6
ES	19.9	7	ES	20.0	7	ES	19.7	7	ES	19.8	7	ES	19.7	7	ES	20.0	7
BE	20.6	8	BE	20.6	8	BE	20.3	8	BE	20.5	8	BE	20.5	8	BE	20.6	8
UK	**20.8**	**9**	**UK**	**20.8**	**9**	**FR**	**20.6**	**9**	**FR**	**20.7**	**9**	**FR**	**20.7**	**9**	**UK**	**20.8**	**9**
FR	**20.9**	**10**	**FR**	**20.9**	**10**	**UK**	**20.6**	**10**	**UK**	**20.7**	**10**	**UK**	**20.7**	**10**	**FR**	**20.9**	**10**
DK	20.9	11	DK	21.0	11	DK	21.2	11	DK	20.9	11	DK	20.9	11	DK	21.0	11
SE	27.6	12	SE	27.5	12	SE	27.3	12	SE	27.5	12	SE	27.6	12	SE	27.5	12

Men, age 50, Eurostat lifetable

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	14.0	1	DE	14.0	1	DE	14.0	1	DE	13.9	1	DE	14.1	1	DE	14.0	1
PL	15.9	2	PL	15.8	2	PL	15.9	2	PL	15.9	2	PL	15.9	2	PL	15.8	2
AT	16.4	3	AT	16.5	3	AT	16.4	3	AT	16.3	3	AT	16.3	3	AT	16.5	3
IT	17.8	4	IT	17.8	4	IT	17.7	4	IT	17.7	4	IT	17.6	4	IT	17.8	4
CZ	18.1	5	CZ	18.2	5	CZ	18.0	5	CZ	18.0	5	CZ	18.2	5	CZ	18.2	5
DK	19.1	6	DK	19.0	6	DK	18.9	6	DK	19.1	6	DK	19.4	6	DK	19.0	6
UK	19.7	7	UK	19.7	7	UK	19.5	7	UK	19.6	7	UK	19.7	7	UK	19.7	7
NL	19.8	8	NL	19.8	8	NL	19.6	8	NL	19.8	8	ES	19.9	8	NL	19.8	8
FR	**20.0**	**9**	**ES**	**19.9**	**9**	**FR**	**19.7**	**9**	**FR**	**19.9**	**9**	**NL**	**20.0**	**9**	**ES**	**19.9**	**9**
ES	**20.0**	**10**	**FR**	**19.9**	**10**	**ES**	**19.8**	**10**	**ES**	**20.0**	**10**	**FR**	**20.0**	**10**	**FR**	**19.9**	**10**
BE	20.7	11	BE	20.8	11	BE	20.5	11	BE	20.6	11	BE	20.5	11	BE	20.8	11
SE	26.8	12	SE	26.8	12	SE	26.5	12	SE	26.7	12	SE	26.8	12	SE	26.8	12

Source: SILC and Eurostat

Once we estimate HLY with graduated mortality rates of the HMD data, the absolute differences also remain small, however the change in rankings for some countries is different, indicating that the mortality part can also affect HLY estimates.

Figure 7: Healthy Life Years at age 0, by different smoothing methods, year 2014, selected European countries, with mortality graduation

Women, at birth, with mortality graduated and smoothed (HMD)

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	55.1	1	DE	55.0	1	DE	54.8	1	DE	55.1	1	DE	54.9	1	DE	56.1	1
NL	57.8	2	NL	57.7	2	NL	57.6	2	NL	57.8	2	NL	57.8	2	NL	59.2	2
AT	58.7	3	AT	58.7	3	AT	58.1	3	AT	58.5	3	AT	58.5	3	AT	59.3	3
DK	60.4	4	DK	60.2	4	DK	60.6	4	DK	60.4	4	DK	60.3	4	DK	62.2	4
IT	62.7	5	IT	62.8	5	IT	62.4	5	IT	62.7	5	IT	62.4	5	IT	63.2	5
PL	63.2	6	PL	63.2	6	PL	63.0	6	PL	63.1	6	PL	63.0	6	PL	63.5	6
BE	64.2	7	BE	64.2	7	BE	63.8	7	BE	64.2	7	BE	64.1	7	BE	64.8	7
UK	64.5	8	UK	64.5	8	UK	64.3	8	UK	64.4	8	**UK**	**64.4**	**8**	**ES**	**65.2**	**8**
FR	64.8	9	FR	64.8	9	ES	64.5	9	FR	64.6	9	FR	64.5	9	UK	65.3	9
ES	**64.9**	**10**	**ES**	**64.9**	**10**	**FR**	**64.5**	**10**	**ES**	**64.7**	**10**	**ES**	**64.7**	**10**	**FR**	**65.5**	**10**
CZ	65.4	11	CZ	65.4	11	CZ	65.0	11	CZ	65.3	11	CZ	65.3	11	CZ	65.6	11
SE	72.6	12	SE	72.5	12	SE	72.2	12	SE	72.5	12	SE	72.5	12	SE	73.0	12

Men, at birth, with mortality graduated and smoothed (HMD)

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	55.2	1	DE	55.2	1	DE	55.1	1	DE	55.2	1	DE	55.2	1	DE	56.0	1
AT	58.3	2	AT	58.2	2	AT	58.2	2	AT	58.2	2	AT	58.2	2	AT	59.0	2
DK	60.0	3	DK	59.8	3	DK	59.5	3	DK	60.0	3	**DK**	**60.0**	**3**	**PL**	**60.6**	**3**
PL	60.2	4	PL	60.1	4	PL	60.1	4	PL	60.1	4	**PL**	**60.1**	**4**	**DK**	**60.9**	**4**
NL	62.7	5	NL	62.9	5	NL	62.4	5	NL	62.6	5	**NL**	**62.6**	**5**	**IT**	**63.4**	**5**
IT	62.9	6	IT	63.0	6	IT	62.7	6	IT	62.9	6	**IT**	**62.8**	**6**	**NL**	**63.5**	**6**
UK	63.6	7	UK	63.6	7	UK	63.4	7	UK	63.6	7	**UK**	**63.6**	**7**	**CZ**	**64.0**	**7**
FR	63.8	8	FR	63.8	8	FR	63.4	8	FR	63.7	8	FR	63.7	8	FR	64.4	8
CZ	63.9	9	CZ	63.9	9	CZ	63.6	9	CZ	63.8	9	**CZ**	**63.8**	**9**	**UK**	**64.5**	**9**
ES	64.4	10	ES	64.3	10	ES	64.1	10	ES	64.4	10	ES	64.3	10	ES	64.7	10
BE	64.7	11	BE	64.6	11	BE	64.5	11	BE	64.6	11	BE	64.6	11	BE	64.9	11
SE	73.1	12	SE	73.1	12	SE	72.8	12	SE	73.1	12	SE	73.1	12	SE	73.3	12

Source: SILC and HMD

As with the no graduation estimates, the differences between countries are different for HLY at birth and at 50, but remain small.

Figure 8: Healthy Life Years at age 50, by different smoothing methods, year 2014, selected European countries, with mortality graduation

Women, age 50, with mortality graduated and smoothed (HMD)

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1	DE	14.3	1
AT	16.4	2	AT	16.4	2	AT	16.0	2	AT	16.3	2	AT	16.4	2	AT	16.4	2
NL	**17.6**	**3**	**NL**	**17.5**	**3**	**IT**	**17.4**	**3**	**IT**	**17.5**	**3**	**IT**	**17.2**	**3**	**NL**	**17.5**	**3**
IT	**17.6**	**4**	**IT**	**17.6**	**4**	**NL**	**17.7**	**4**	**NL**	**17.6**	**4**	**PL**	**17.6**	**4**	**IT**	**17.6**	**4**
PL	**17.7**	**5**	**PL**	**17.7**	**5**	**PL**	**17.7**	**5**	**PL**	**17.6**	**5**	**NL**	**17.8**	**5**	**PL**	**17.7**	**5**
ES	19.2	6	ES	19.3	6	ES	19.0	6	ES	19.1	6	ES	19.1	6	ES	19.3	6
CZ	19.6	7	CZ	19.5	7	CZ	19.3	7	CZ	19.5	7	CZ	19.6	7	CZ	19.5	7
BE	20.6	8	BE	20.6	8	BE	20.3	8	BE	20.5	8	BE	20.5	8	BE	20.6	8
UK	20.8	9	UK	20.8	9	UK	20.6	9	**FR**	**20.7**	**9**	**FR**	**20.7**	**9**	UK	20.8	9
DK	**21.0**	**10**	**FR**	**20.9**	**10**	**FR**	**20.7**	**10**	**UK**	**20.7**	**10**	**UK**	**20.7**	**10**	**FR**	**20.9**	**10**
FR	**21.0**	**11**	**DK**	**21.0**	**11**	**DK**	**21.2**	**11**	**DK**	**20.9**	**11**	**DK**	**20.9**	**11**	**DK**	**21.0**	**11**
SE	27.6	12	SE	27.5	12	SE	27.3	12	SE	27.5	12	SE	27.6	12	SE	27.5	12

Men, age 50, with mortality graduated and smoothed (HMD)

1-year			5-year			10-year			Spline			Polynomial			No disability before age 16		
Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank	Country	HLY	rank
DE	14.0	1	DE	14.0	1	DE	14.0	1	DE	13.9	1	DE	14.1	1	DE	14.0	1
PL	15.9	2	PL	15.9	2	PL	15.9	2	PL	15.9	2	PL	16.0	2	PL	15.9	2
AT	16.4	3	AT	16.5	3	AT	16.4	3	AT	16.3	3	AT	16.3	3	AT	16.5	3
IT	17.8	4	IT	17.8	4	IT	17.7	4	IT	17.8	4	IT	17.7	4	IT	17.8	4
CZ	18.1	5	CZ	18.2	5	CZ	18.0	5	CZ	18.1	5	CZ	18.2	5	CZ	18.2	5
ES	19.0	6	ES	19.0	6	**DK**	**18.9**	**6**	**ES**	**19.0**	**6**	ES	19.0	6	ES	19.0	6
DK	19.1	7	DK	19.0	7	**ES**	**18.9**	**7**	**DK**	**19.1**	**7**	DK	19.4	7	DK	19.0	7
UK	19.7	8	UK	19.7	8	UK	19.5	8	UK	19.6	8	UK	19.7	8	UK	19.7	8
NL	19.8	9	NL	19.8	9	NL	19.6	9	NL	19.8	9	NL	20.0	9	NL	19.8	9
FR	20.0	10	FR	20.0	10	FR	19.7	10	FR	19.9	10	FR	20.1	10	FR	20.0	10
BE	20.7	11	BE	20.8	11	BE	20.5	11	BE	20.6	11	BE	20.5	11	BE	20.8	11
SE	26.8	12	SE	26.8	12	SE	26.5	12	SE	26.7	12	SE	26.9	12	SE	26.8	12

Source: SILC and HMD

4. Discussion

Our preliminary results indicate that smoothing the prevalence of disability by age has very little impact on HLY estimation. Graduating and smoothing mortality also presented no substantial effect. However, one important result was the assumption of no disability before age 16. On all the variants tested, this was the one that had the highest impact on HLY at birth, most probably because this aspect directly impacts the younger ages. Nonetheless, some countries experience changes in rankings when merely adopting different smoothing strategies, which merits further investigation.

As a future step, we plan on decomposing the HLY into disability and mortality contributions, to test whether these small differences are driven by the prevalence or by mortality part and whether the summary result is masking any significant differences in prevalence by age.

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